Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, February 9-th, 2010

(16:00 in Room 459/30b)

A Short Summary of First Operational Experience with the LHC;
Tune Resonance Phenomena in the SPS and
Machine Protection via Fast Position Interlocking

Tobias Bär

University of Hamburg / CERN

Abstract

After the incident and more than one year without beam the commissioning of the LHC started again on November 20, 2009. Closed orbits were established for both beams and the beams were captured within eight hours. Conditions which allowed first collisions were established only after three days. The first (shorter) part of the talk will briefly summarize the experience gained and the problems encountered during the first weeks of LHC operation.

The major part of the talk is dedicated to tune resonance phenomena in the Super Proton Synchrotron (SPS) at CERN. The 6911m long SPS with a peak energy of 450GeV is at the top of the LHC preaccelerator-complex. The SPS has a known vulnerability to fast equipment failures that led to an uncontrolled loss of a high intensity beam in 2008, which resulted in major damage of a main dipole. The beam loss was caused by a fast tune decrease towards an integer resonance. Simulations and distinct experimental studies provide clear understanding of the beam dynamics at different SPS tune resonances. The resonance phenomena lead to a complete beam loss in as little as 10 turns (230 μs) after reaching the stop band of the resonance, whereas the current interlock systems on the main power converters have a delay of 7–12ms. To counteract the vulnerability of the SPS, current research focuses on a new fast position interlock system which is planned to become operational in the first quarter of 2010.

J.Roßbach (Univ. HH) and M.Vogt (MPY).

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